Sprayed on Applic
CAUTIC
ASBESTU
DUST HAZA
OCCUPATIONAL HEALTH
Occu
and Safety Division

87-04112/

The Occupational Hygiene Branch is pleased to have sponsored the production of this booklet.

It is hoped that this publication will assist in minimizing the potential health risks associated with sprayed-on asbestos containing applications. This booklet is intended to provide information and guidelines to those involved in asbestos control throughout the province.

Many thanks to those individuals who provided input in the preparation of this booklet by sharing their knowledge and experiences.

Requests for additional information should be addressed to this Branch.

David E. Gibson
Director
Occupational Hygiene Branch

First Edition Aug. 1981
Second Edition Sept. 1982
Third Edition Sept. 1986

ASBESTOS CONTROL
SPRAYED-ON APPLICATIONS

Alberta
COMMUNITY AND
OCCUPATIONAL HEALTH
Occupational Health and Safety Division

TABLE OF CONTENTS

	Page
Introduction	6
Health Effects	7
Applicable Standards	8
Recognizing And Evaluating The Hazard	9
Controlling The Hazard	13
Environmental Monitoring For Airborne Asbestos	29
Respiratory Protection	30
Transport And Disposal Of Asbestos Containing Refuse	32

I INTRODUCTION

Asbestos is a term that has been given to a group of mineral fibres occurring naturally in the earth. The major types of asbestos are chrysotile (white asbestos), amosite (brown asbestos), crocidolite (blue asbestos), tremolite and anthophyllite.

In the past, asbestos was used extensively as a major component of some sprayed fireproofing, insulating, acoustical and decorative materials.

It has been recognized that potentially hazardous situations may exist in some buildings where sprayed applications of asbestos containing material are found. Over time, asbestos fibres can be released due to workers performing maintenance, water damage, or general degradation due to aging. Air movement from ventilation systems or overhead heaters can also dislodge asbestos fibres from the surface.

The degree of hazard associated with sprayed-on asbestos containing surfaces is dependent upon its accessibility, condition, friability, contact with air currents, and the type and percentage of asbestos in the material. All six factors must be assessed in order to evaluate the hazard potential.

After determining the degree of hazard, a decision must be made as to the necessity for and the extent of control measures. When there is little or no evidence of a hazard, the surface may be left intact. In this instance, however, a continuing inspection program is required. Where there is a need for control, several measures can be employed. Three acceptable measures of control are: enclosure, encapsulation and removal.

Choice of the appropriate control measure requires careful consideration. There are distinct advantages and disadvantages associated with each.

Primary consideration must be given to the health of the workers instituting the controls and to the health of those who will occupy the area upon completion of the job. It is therefore necessary to follow stringent work procedures and to adopt proper techniques, as outlined in this booklet.

II HEALTH EFFECTS

Three main diseases associated with inhalation of asbestos fibres are:

a. **Asbestosis**

Asbestosis is a lung disease resulting from prolonged and heavy occupational exposure to asbestos dust. It can take anywhere from 10 to 30 years to appear. The primary complaint is breathlessness, which comes on gradually and increases as the disease progresses. Asbestosis can be diagnosed by chest X ray. Occasionally, changes may be detected by lung function testing before they show up on a chest X ray.

b. **Lung Cancer**

Asbestos workers have an increased risk of developing lung cancer. This increased risk is greater for smokers than non-smokers. Asbestos workers can take an important step in safe guarding their health by not smoking.

c. **Mesothelioma**

This fatal disease is an extremely rare cancer of the lining of the chest (pleura) or the abdominal cavity (peritoneum). Most people who develop this disease have had some exposure to asbestos, although not always an occupational exposure. Household contacts of asbestos workers, who may bring home the material on their clothes, have been reported to contract this disease. The development of mesothelioma is not always related to the amount of asbestos inhaled or the duration of the exposure.

III APPLICABLE STANDARDS

The Chemical Hazards Regulation (Alta. Reg. 8/82), the Asbestos Regulation (Alta. Reg. 7/82) and the General Safety Regulation (Alta. Reg. 448/83) should be consulted for details of applicable sections.

The Chemical Hazards Regulation outlines requirements for worker training and education and establishes Occupational Exposure Limits for worker exposure to the different types of asbestos.

The Asbestos Regulation sets out requirements for work practices and procedures and establishes requirements for medical surveillance of workers exposed to asbestos on a continuing basis.

The General Safety Regulation outlines requirements for the competency of workers, the selection, use and maintenance of respiratory protective equipment and other safety related issues.

These regulations are available from Alberta Government Publication Services.

Questions regarding the medical surveillance of asbestos-exposed workers should be forwarded to:

The Director
Medical Services Branch
4th Floor, 10709 Jasper Avenue
Edmonton, Alberta
T5K 3N3

Phone: (403) 427-6724

IV RECOGNIZING AND EVALUATING THE HAZARD

Proper evaluation of the potential hazard associated with sprayed-on asbestos containing material includes a visual inspection, consideration of the level of activity in the area and determination of the amount of asbestos in the material.

a. **Visual Inspection**

A visual inspection assesses the accessibility, condition and friability of the material, and its presence in air plenums.

"Accessibility" relates to how easily people can reach the material. Easy accessibility leaves the material open to accidental or intentional damage.

The "condition" of the material is a combination of the quality of installation, material deterioration and damage. Deterioration and damage may be caused by such things as water leakage or spills, vibration, air movement across the surface, and disruption of the surface by birds or animals.

The ease with which a material will crumble is referred to as "friability". The more friable the material, the greater potential for fibre release.

Friable asbestos containing material found within air plenums increases the hazard since fibres may be picked up by moving air and spread throughout the building.

There are several schemes in use to rate the overall asbestos hazard. An example of one scheme is outlined in Table I. It must be stressed that only partial reliance should be placed on these systems. A great deal of judgement on the part of the investigator is required.

TABLE I

Rating Scheme

The following simple scheme can be used for the evaluation.

FACTOR	RATING	DESCRIPTION
Accessibility	High (H)	Accessible in high activity areas
	Medium (M)	Accessible in low activity areas or beyond the reach of area occupants
	Low (L)	Enclosed
Condition	High (H)	Severe damage
	Medium (M)	Mild - moderate damage
	Low (L)	Good condition
Friability	High (H)	Easily breaks apart
	Medium (M)	Mild - moderate friability
	Low (L)	Non-friable, firmly bound

Decision Table

	Not in Return Air Plenum		
	Less than 20% asbestos	Greater than 20% asbestos	Asbestos Present in Return Air Plenum
Immediate Control	2 H's or 3 M's	1 H or 2 M's	Control required
Control Required	1 H or 2 M's	1 M	unless 3 L's and
No Control	1 M or 3 L's	3 L's	less than 20%

b. **Activity Level Assessment**

The level of activity in the area must also be considered. This would include the number of workers in the area, the length of time spent and the type of work performed in the area. For example, a boiler room where workers are present only intermittently might be considered less hazardous than a production area where many employees work continuously for a full shift.

c. **Sampling of Suspected Asbestos Containing Material**

The sampling and analysis of suspected asbestos containing material is extremely important. Neither visual inspection nor checking building records is adequate to establish the presence of asbestos. Suspect material could contain glass fibres, cellulose or other non-asbestos mineral fibres. The decision to take corrective action will depend, to a great extent, on the results of the laboratory analysis. It is therefore critical that sampling in buildings is carried out properly and that laboratory analyses are performed accurately.

Generally, one sample should be taken for each room or area containing the same material. For large areas two samples should be taken. If there is material of a different texture or colour it should be sampled separately.

A representative sample should be taken within the suspect material itself by penetrating the entire depth. This kind of sample is called a bulk sample.

Follow these procedures when taking a bulk sample:

(i) Use a small container, such as a wide-mouthed glass jar with a screw on lid. It should be clean and dry.

(ii) Gently twist the open end of the container into the material. A core of the material should fall into the container. A sample can also be taken by using a knife to cut out or scrape off a small piece of material and then placing it into the container.

Be sure to penetrate any paint or protective coating and all the layers of the material. If the sample container cannot penetrate the material, consider whether the material is really friable or not.

(iii) Tightly close the sample container. Wipe the exterior of the container with a damp cloth to remove any material which may have adhered to it.

(iv) Tape the container lid to prevent the accidental opening of the container during shipment or handling.

(v) Label the sample container with a sample identification number, the name of the building and the sample location within the building.

(vi) Send the sample to a competent laboratory for analysis. The Occupational Hygiene Branch can advise you of laboratories which are able to undertake asbestos analyses.

Precautions should be taken when obtaining bulk samples. If large numbers of samples are to be taken, a respirator approved for protection against asbestos dust should be worn. Workers in the immediate area of the sampling operation should temporarily vacate their work stations. Preferably, samples should be taken when the area is not in use.

V CONTROLLING THE HAZARD

Three acceptable control methods are available. Consider the advantages and disadvantages of each method before making a decision. Stringent procedures are then required.

A. Asbestos Removal

The removal operation involves the wetting, removal, collection and disposal of all the sprayed-on asbestos containing material from the supporting surface.

1. Advantages and Disadvantages

The advantage of removal is that the asbestos is completely removed from the area of concern. Therefore, the immediate, as well as potential future hazard is eliminated.

There are, however, several disadvantages associated with this method:

- High airborne concentrations are generated during removal, unless stringent control measures are used.
- Improper removal procedures may result in risk for subsequent occupants of the area and the contamination of adjacent areas.
- Work routine and production are affected as a result of the necessary shutdown of area.
- Provisions must be made for the transport and disposal of debris.
- A substitute is required to fulfill the original purpose of the asbestos containing material.

2. Dry Removal

Dry removal of sprayed-on asbestos surfaces is not recommended, because it results in a very high concentration of airborne asbestos. In extremely rare cases, where wet removal is impossible, dry removal may be necessary. Additional information should be obtained from the Occupational Hygiene Branch prior to such action.

3. Procedure For Wet Removal

(i) General Provisions

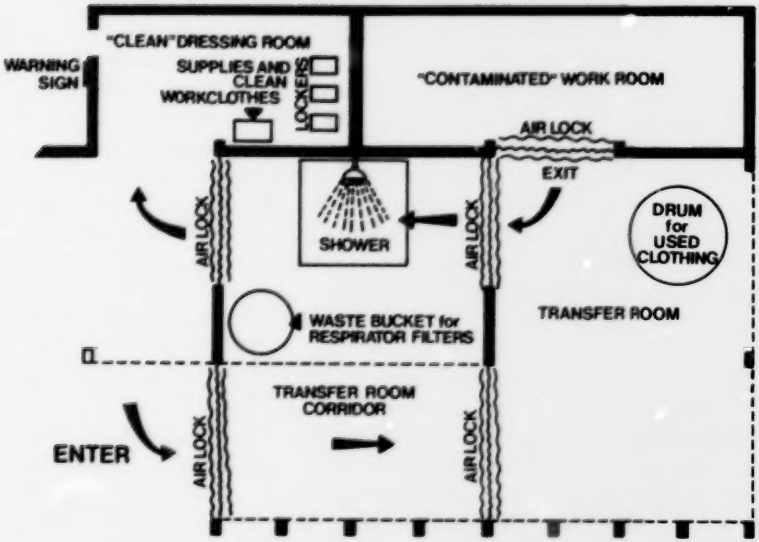
The following measures must be taken when removing sprayed-on applications of asbestos:

- Information must be readily available to all workers regarding potential health hazards of exposure to asbestos fibres. A code of practice or a manual with written safe practice procedures and a copy of the Alberta Asbestos Regulations must be readily available at the work site.
- A competent supervisor must be at the work site at all times to ensure that work procedures are executed properly.
- All furniture and other moveable objects should be removed from the work area. Non-transportable objects should be completely enclosed with heavy duty plastic sheeting.
- Notices must be posted around the perimeter designating the area as restricted. Only authorized personnel are allowed in the area.
- Full body disposable coveralls, caps, rubber boots or easily decontaminated footwear must be provided by the employer and worn by all workers entering the work area. If necessary, other protective devices such as goggles and hard hats must also be worn. If cloth coveralls are used, arrangements must be made to have them laundered by individuals fully aware of the precautionary measures to follow with asbestos contaminated clothing.
- Approved respirators (see Table II, page 31) must be provided by the employer and worn by all workers entering the work area. All workers must be familiar with the correct use and limitations of the respirators. Respirators must be properly fitted and maintained. Beards, sideburns and moustaches which interfere with the respirator's fit are not permitted.

- The work area must be sealed off from other areas in the building. Walls and floors must be covered with heavy duty polyethylene or similar impermeable material. All openings such as doors and windows must be sealed with polyethylene taped securely in place. Entrances and exits of the work area must be controlled with air locks.
- A decontamination area with a changeroom, shower and an equipment area must be provided. Adequate separate storage facilities must be supplied for street and work clothes.
- Diagram I details a typical work site floor plan for asbestos removal.
- All supply and return air vents from the heating and ventilating system, including air conditioning, must be effectively blocked off to prevent air flow. A double layer of heavy duty polyethylene, with seams taped, is recommended. The ventilation system should be checked to see if blockage will adversely affect the system. Where possible, the entire ventilation system should be turned off to avoid contaminating other areas in the building with asbestos.
- A separate ventilation system including makeup and exhaust should be installed to maintain a slight negative pressure in the area. This will ensure that contaminated air does not seep to adjacent areas. Exhaust used to provide this negative pressure must be vented to the outside of the building through an effective air cleaning device.
- Suitable wetting agents are to be used. The agent, when mixed with water, increases penetration of liquid through the asbestos containing material.
- Provision must be made for the drainage or cleanup of the excess water associated with the wet method. If proper procedures are followed using a wetting agent, excess water may not create a problem.

DIAGRAM 1

Floor Plan For A Typical Asbestos Removal, Enclosure or Encapsulation Work Site



- Toilet facilities, such as a chemical toilet, may be necessary in the work area.
- A vacuum cleaner equipped with at least a two-stage filter system is required for cleaning of clothes and decontamination of the work area. The final filter must be a high efficiency particulate air filter (HEPA).
- Plastic bags of a minimum thickness of six mil must be used for disposal of the asbestos containing material and contaminated clothing. It is advisable to place the plastic bags in sturdy containers (large drums). If a very large amount of material is expected, other non-reusable closed containers may be considered.
- Provisions must be made to ensure compliance with all applicable codes and regulations, such as fire, building, and Occupational Health and Safety Regulations.

(ii) **Work Routine**

- All workers entering the "contaminated" work room must change into coveralls, boots, caps and approved respirators.
- The asbestos surface must be completely wetted down and thoroughly soaked with water containing the wetting agent. Coverings that cannot be penetrated by water must be pierced to allow adequate soaking.
- The soaked material should be removed in a systematic fashion by scraping or similar means. No sandblasting, high pressure water or other abrasive techniques are permitted.
- Workers must ensure that removal is complete and no asbestos containing material remains on overhanging pipes or surfaces.
- The floor area should be kept damp to prevent fibres from becoming airborne.
- Avoid the slipping hazard posed by the damp floor.
- Removed material should, while still wet, be placed immediately into plastic bags to prevent the spread of fibres. These plastic bags should be put into another plastic bag or a drum. This should be done in the transfer area to ensure that contamination on the outside of the original container is not spread.

- All bags and containers must be labelled "Contains Asbestos, Cancer Hazard, Avoid Breathing Dust."
- Eating, drinking or smoking is prohibited in the work, transfer and shower areas since this would require the removal of the respirator. Workers should be completely aware of the association between smoking and asbestos-related diseases.

(iii) **Personal Decontamination**

- Before leaving the work area for any reason, the worker must remove visible contamination from his clothing, using a damp cloth, gentle brushing or vacuuming.
- In the transfer room, all clothing and protective apparel, except the respirator, are to be removed.
- The worker is to enter the shower with the respirator initially still in place.
- After the head, face and respirator are thoroughly washed, the respirator is removed.
- The used filters are discarded in a waste container in the shower or clean area.
- Following a complete shower, the worker proceeds to the "clean" dressing room to put on street clothing.

(iv) **Work Area Clean-up and Decontamination**

- When asbestos removal is complete, all contaminated tools and equipment must be thoroughly washed or vacuumed. Disposable clothing and all non-reuseable material must be placed in labelled heavy duty plastic bags.
- All bagged asbestos waste must be removed from the work site (see Transport and Disposal of Asbestos Containing Refuse, page 32).
- To minimize asbestos contamination, polyethylene sheeting enclosing the areas should not be removed until the airborne asbestos concentration in the area is less than 10% of the Occcupational Exposure Limit for the particular type of asbestos present. This level is achieved through:

  a. careful adherence to proper procedures as outlined.

b. removal of fibres by purging the air in the contaminated area and/or allowing sufficient time to elapse to ensure adequate settling of fibres, with subsequent clean-up procedures.

c. spraying all polyethylene surfaces with adhesive to entrap fibres present on the plastic.

- All exposed surfaces in the work area must be cleaned. A thorough vacuuming (two-stage - HEPA filter) of all floors and surfaces is necessary to ensure adequate clean-up. Vacuum refuse must be soaked and disposed of in plastic bags.
- When airborne asbestos levels have been reduced, the enclosures may be removed. The sheeting should be folded so that the contaminated side is inside. It should then be placed in bags or drums, labelled and disposed of along with other refuse.
- The bagged refuse should be carefully transported in a covered vehicle to a prearranged sanitary landfill site. (see Transport and Disposal of Asbestos Containing Refuse, page 32).

B. Asbestos Encapsulation

Asbestos containing material is coated with a bonding agent called a sealant. Penetrating and bridging sealants are the two types used to prevent fibre release from the asbestos material.

1. Advantages and Disadvantages

The advantages of the encapsulation operation are that:

- Time required to complete the operation may be less than for either removal or enclosure.
- No transport, or disposal requirements of asbestos containing material are necessary.
- The original purpose of asbestos containing material may not be altered.
- Accessibility to fixtures may not be restricted.
- Sealants can often be used in areas which are less accessible for removal or enclosure.

The disadvantages associated with this method of control are:

- Asbestos has not been removed. Therefore, asbestos exposure may occur during maintenance, alteration or demolition.
- Sealants are not rigid surfaces and physical abuse will decrease their control value.
- The effective life of the sealant may be less than the expected life of the structure involved. Sealants may deteriorate with time.
- The sealant may create a vapor barrier. This may result in water collecting in the sprayed-on material, affecting the bond to the supporting surface.
- Asbestos containing surfaces must be intact and in non-friable condition prior to encapsulation.
- Surface must be capable of supporting the additional weight of the sealant.
- Great difficulty may be experienced if it becomes necessary to remove the encapsulated material.
- A continuing inspection program is required to check for damage to the encapsulated surface.

2. Procedure for Encapsulation

(i) General Provisions

There are certain hazards in the process of encapsulation. The following precautionary measures must be followed:

- Workers involved in the encapsulation procedure must be fully informed of the adverse health effects of asbestos. A code of practice or a manual with written safe practice procedures and a copy of the Alberta Asbestos Regulations must be readily available at the work site.
- It is necessary that a competent supervisor be at the work site at all times to ensure that work procedures are executed in a proper manner.
- Full body disposable coveralls, caps, rubber boots or easily decontaminated footwear must be worn by all workers entering the work area. If necessary, other protective devices such as goggles and hard hats must also be worn. If cloth coveralls are used, arrangement must be made to have them laundered by individuals fully aware of the precautionary measures to follow with asbestos contaminated clothing.
- Approved respirators (see Table II) must be provided by the employer and worn by all employees entering the work area. All workers must be familiar with the correct use and limitations of the respirators. Respirators must be properly fitted and maintained. Beards, sideburns and moustaches which interfere with the respirator's fit are not permitted.
- A sealant acceptable to the Building Standards Branch of Alberta Labour must be used. Sealants are to be applied using airless spray equipment at a low-pressure setting.

For further information on sealant materials contact:

Building Standards Branch
Alberta Labour
Edmonton, Alberta
Ph. (403) 427-8265
Calgary, Alberta
Ph. (403) 297-5765

- Notices must be posted around the perimeter of the area, designating it as restricted. Only authorized personnel are allowed in the work area.
- Provisions must be made to prevent the spread of contaminants from the work area to adjoining areas. Walls and floors must be covered with heavy duty polyethylene or similar impermeable material. All openings such as doors and windows must be sealed with polyethylene taped securely in place. Entrances and exits must be controlled with air locks.
- Heating and ventilation systems must be sealed off to prevent contamination of the duct work. If it is possible, the system should be turned off to prevent contamination of other areas in the building.
- A slight negative pressure should be applied to the work area using an exhaust system with effective air filtration (two-stage - HEPA).
- A decontamination area with a changeroom, shower and an equipment area must be provided (see Diagram 1). Separate storage facilities must be supplied for street and work clothes.
- Toilet facilities, such as a chemical toilet, may be necessary in the work area.
- Provisions must be made to ensure compliance with all applicable codes and regulations, such as fire, building, and Occupational Health and Safety Regulations.
- The presence of hidden asbestos under the sealant must be recorded to ensure that adequate precautions will be taken if future alterations, renovation, maintenance or demolition occurs.

(ii) **Work Routine**

- All workers entering the work area must change into coveralls, footwear, caps and approved respirators.
- The encapsulation procedure must be carried out in accordance with manufacturer's instructions and in such a fashion as to minimize damage to the asbestos surface.
- Contents of the work area such as furniture or machinery must be removed or covered with heavy duty plastic sheeting.

- Any debris which may have been dislodged during the spraying must be disposed of in a sealed container (six mil plastic bag).
- There should be no eating, drinking or smoking in the work area, as this requires removal of respirators.

(iii) **Personal Decontamination**

- Before leaving the work area for any reason the worker must perform all decontamination procedures.
- Visible contamination from clothing must be removed by using a damp cloth, gentle brushing or vacuuming.
- In the transfer room, all clothing and protective apparel except the respirator, is to be removed.
- The worker enters the shower with the respirator initially still in place.
- After the head, face and respirator are thoroughly washed, the respirator is removed and the used filters are discarded in a waste container.
- Following a complete shower the worker proceeds to the "clean" dressing room to put on street clothing.

(iv) **Work Area Clean-up and Decontamination**

- All contaminated tools and equipment must be thoroughly washed and/or vacuumed. Disposable clothing and all non-reusable materials must be placed in labelled heavy duty plastic bags.
- Bagged asbestos waste must be removed from the worksite (See Transport and Disposal of Asbestos Containing Refuse).
- To minimize asbestos conntamination, polyethylene sheeting enclosing the areas should not be removed until the airborne asbestos concentration in the area is less than 10% of the Occupational Exposure Limit for the particular type of asbestos present. This level is achieved through:
  a. careful adherence to proper procedures as outlined.

b. removal of fibres by purging the air in the contaminated area and/or allowing sufficient time to elapse to ensure adequate settling of fibres, with subsequent clean-up procedures.
c. spraying all polyethylene surfaces with adhesive to entrap fibres present on the plastic.

- All exposed surfaces in the work area must be cleaned. A thorough vacuuming (two-stage - HEPA filter) of all floors and surfaces is necessary to ensure adequate clean-up. Vacuum refuse must be soaked and disposed of in plastic bags.
- When airborne asbestos levels have been reduced, the enclosures may be removed. The sheeting should be folded so that the contaminated side is inside. It should then be placed in bags or drums, labelled and disposed of along with other refuse.
- The bagged refuse should be carefully transported in a covered vehicle to a prearranged sanitary landfill site. (see Transport and Disposal of Asbestos Containing Refuse, page 32).

C. Asbestos Enclosure

Enclosure involves erecting barriers between the asbestos containing material and the building environment using material such as gypsum board, plywood or metal.

1. Advantages and Disadvantages

The advantages of the enclosure operation are that:

- Fibre generation may be less than in asbestos removal.
- Time required to complete the enclosure procedure may be less than for removal.
- No transport or disposal of asbestos containing material is required.

The disadvantages associated with this method are that:

- Asbestos has not been removed. Therefore, further asbestos exposure may occur during maintenance, structural alteration or demolition.
- Additional weight of the barrier may increase the structural load, possibly contravening building codes.
- Accessibility to fixtures such as wiring, plumbing or ventilation may be restricted.
- Incorrect selection and installation of the barrier may alter the original character of the surface.
- Attaching the enclosing barrier may be difficult.

2. Procedure for Enclosure

(i) General Provisions

The following precautionary measures must be followed when enclosing sprayed-on applications of asbestos:

- Workers involved in the enclosure procedure must be fully informed of the adverse health effects of asbestos. A code of practice or a manual with written safe practice procedures and a copy of the Alberta Asbestos Regulations must be readily available at the work site.

- A competent supervisor must be at the work site at all times to ensure that work procedures are executed in a proper manner.
- Gypsum board, metal, plywood or other coverings used to enclose asbestos surfaces must conform to appropriate building codes.
- Suspended ceilings are not acceptable as an enclosure except when used in combination with encapsulation.
- The presence of the hidden asbestos under the enclosure must be recorded to ensure that adequate precautions will be taken if future alterations, renovations, maintenance or demolition occur.
- Notices must be posted around the perimeter of the area, designating it as restricted. Only authorized personnel are allowed in the work area.
- An area must be designated for a changeroom. Provision must be made for the separate storage of street and work clothing.
- Adequate provisions must be made to prevent the spread of fibres to adjoining areas. The use of polyethylene sheeting or similar impervious material is considered acceptable. All supply and return air vents must be blocked off to prevent contamination of the ductwork.
- In some instances it may be necessary to provide a slight negative pressure in the work area. This should ensure that contaminated air does not seep into adjacent areas. Fans used to provide negative pressure must be vented to the outside through an effective filter system.
- All workers entering the restricted area must wear suitable work clothing and any safety equipment required. If disposable clothing is not worn, work clothes must be laundered by individuals fully aware of the precautionary measures to follow with asbestos contaminated clothing.
- Approved respirators (see Table II) must be provided by the employer and worn by all workers entering the work area.
- No eating, drinking or smoking is allowed in the work area, as this requires the removal of respirators.

(ii) **Work Routine**

- All workers entering the work area must change into suitable work clothes and wear approved repirators.
- Contents of the work area such as furniture or machinery must be removed or covered with heavy duty polyethylene sheeting.
- The application of the enclosure should be carried out in such a fashion as to minimize the damage to the asbestos containing surface.
- All joints or seams in the enclosing material must be effectively sealed to prevent escape of asbestos fibres.
- No tools are to be taken from the work area unless they are cleaned by washing or vacuuming.

(iii) **Personal Decontamination**

- Before leaving the work area for any reason, visible contamination must be removed from clothing by using a damp cloth, gentle brushing or vacuuming
- At the end of the work shift workers must remove work clothes, leave them at the work site and shower before changing into street clothing.

(iv) **Work Area Clean-up and Decontamination**

- All contaminated tools and equipment must be thoroughly washed and/or vacuumed. Disposable clothing and all non-reusable materials must be placed in labelled heavy duty plastic bags.
- To minimize asbestos contamination, polyethylene sheeting enclosing the areas should not be removed until the airborne asbestos concentration in the area is less than 10% of the Occupational Exposure Limit for the particular type of asbestos present. This level is achieved through:
  a. careful adherence to proper procedures as outlined.
  b. removal of fibres by purging the air in the contaminated area and/or allowing sufficient time

to elapse to ensure adequate settling of fibres, with subsequent clean-up procedures.

c. spraying all polyethylene surfaces with adhesive to entrap fibres present on the plastic.

- All exposed surfaces in the work area must be cleaned. A thorough vacuuming (two-stage - HEPA filter) of all floors and surfaces is necessary to ensure adequate clean-up. Vacuum refuse must be soaked and placed in plastic bags.
- When airborne asbestos levels have been reduced, the enclosures may be removed. The sheeting should be folded so that the contaminated side is inside. It should then be placed in bags or drums, labelled and disposed of along with other refuse.
- The bagged refuse should be carefully transported in a covered vehicle to a prearranged sanitary landfill site. (see Transport and Disposal of Asbestos Containing Refuse, page 32).

VI ENVIRONMENTAL MONITORING OF AIRBORNE ASBESTOS

Airborne monitoring can be used to measure the concentration of asbestos fibres in the air. The membrane filter method is normally used when determining airborne asbestos fibre levels. Due to the precision and accuracy of this method reliable results cannot be obtained when very low fibre concentrations are encountered. Therefore, sampling prior to instituting controls may be inappropriate unless it is wished to establish background levels.

During actual control procedures air monitoring may be appropriate. Where experience is lacking with regard to expected fibre levels, monitoring may be required for proper respirator selection. The type of respirator required depends on the fibre levels encountered.

Air monitoring may also be appropriate to determine if contamination of areas adjacent to the work area has occurred. However, sampling should not be necessary if recommendations outlined in these guidelines are followed.

Monitoring can also be used as a means of determining if clean-up and decontamination procedures were properly carried out.

If environmental monitoring is undertaken, it must be done by competent individuals and samples analyzed by a competent laboratory.

VII RESPIRATORY PROTECTION

In the Province of Alberta, respirators acceptable for protection against asbestos-containing dusts must be approved either:

a) jointly by the Mining Enforcement and Safety Administration and the National Institute for Occupational Safety and Health (U.S.A.), or

b) jointly by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (U.S.A.), or

c) by another standards setting and equipment testing organization acceptable to a Director of the Occupational Health and Safety Division.

Since different respirators offer different degrees of protection, the type of respirator selected varies according to the airborne asbestos concentration encountered. Table II shows the recommended respirator types suitable to specific asbestos concentration ranges. In addition, a guide is given to help determine asbestos concentrations during various control procedures. A code of practice must be established governing the selection, maintenance and use of respiratory protective equipment.

TABLE II

Recommended Respirator Types For Use At Different Airborne Concentrations Of Asbestos

Asbestos Concentration (multiple of Occupational Exposure Limit)	Respirator Type
Less than 10 times the Occupational Exposure Limit	Air purifying ½ face piece replaceable filter type
Less than 50 times the Occupational Exposure Limit	Air purifying full face piece replaceable filter type
Less than 100 times the Occupational Exposure Limit	Air purifying powered respirator
Greater than 100 times the Occupational Exposure Limit	Positive pressure air supplied respirators or self contained breathing apparatus (Type "C")

*Encapsulation and enclosure procedures probably result in a time weighted average concentration of less than 20 fibres/cm³. During enclosure of surfaces which are in poor condition, fibre levels may be considerably higher.

Removal of thoroughly soaked materials (using a wetting agent) is likely to produce time weighted average concentrations of less than 20 fibres/cm³.

Removal of dry or poorly soaked material may result in concentrations considerably greater than 20 fibres/cm³.

VIII TRANSPORT AND DISPOSAL OF ASBESTOS CONTAINING REFUSE

- All asbestos containing refuse must be put in labelled ("CONTAINS ASBESTOS, CANCER HAZARD, AVOID BREATHING DUST") sealed, six mil plastic bags. A dual system in which the bags are sealed in other containers (such as non-reuseable sturdy drums), provides additional protection. In areas where large volumes of refuse are expected or plastic bags are impractical, alternate methods may be considered. Mechanical handling equipment must be fully decontaminated before removal from the work site.
- Care must be taken in transporting asbestos refuse to prevent fibres from becoming airborne. It may be necessary to transport bagged refuse in a covered vehicle or under a tarpaulin.
- The driver of the transport vehicle must be fully informed of asbestos hazards in case the material becomes airborne. The driver must be provided with a respirator to be worn during emergencies or unloading when there may be an asbestos exposure. If bags are severely damaged in transport the contents must be soaked and repackaged prior to dumping.
- All asbestos containing refuse must be disposed of in an approved sanitary landfill site.
- Dump operators in close proximity to the refuse must wear respirators during unloading. The operators must be informed of the contents of the refuse.
- The refuse should be buried immediately.
- Upon completion of the job, vehicles and reusable containers used in the conveyance of the asbestos refuse must be thoroughly washed.

For further information on approved sanitary landfill sites and disposal contact:

Waste Management Branch
Alberta Environment
Edmonton, Alberta
Ph. (403) 427-5868
Calgary, Alberta
Ph. (403) 297-8271

For further information on abestos control contact:

Occupational Hygiene Branch
Northern Region
9321-48 Street
Edmonton, Alberta
T6B 2R4
(403) 427-4792

Occupational Hygiene Branch
Southern Region
2nd Floor, 1021-10 Avenue S.W.
Calgary, Alberta
T2R 0B7
(403) 297-2188

The Occupational Health and Safety Act and regulations are available from:

Publication Services
Government of Alberta
11510 Kingsway Avenue
Edmonton, Alberta
T5G 2Y5
(403) 427-4952

Publication Services
Government of Alberta
601, 620-7 Avenue S.W.
Calgary, Alberta
T2P 0Y8
(403) 297-6251